Developmental long trace profiler using optimally aligned mirror based pentaprism

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Samuel Barber received his BS degree in Physics with a minor in Spanish from the University of California at Los Angeles in 2007. He then completed a brief fellowship at

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Abstract text:

A low-budget surface slope measuring instrument, the Developmental Long Trace Profiler (DLTP), was recently brought to operation at the Advanced Light Source Optical Metrology Laboratory [Nucl. Instr.and Meth. A, doi: 10.1016/j.nima.2009.10.175]. The instrument is based on a precisely calibrated autocollimator and a movable pentaprism. The capability of the DLTP to achieve sub-microradian surface slope metrology has been verified via cross-comparison measurements with other high-performance slope measuring instruments when measuring the same high-quality test optics. In the present work, a further improvement of the DLTP is achieved by replacing the existing bulk pentaprism with a specially designed mirror based pentaprism. A mirror based pentaprism offers the possibility to eliminate systematic errors introduced by inhomogeneity of the optical material and fabrication imperfections of a bulk pentaprism. We provide the details of the pentaprism design and describe an original experimental procedure for precision mutual alignment of the pentaprism mirrors. The algorithm of the alignment procedure and its efficiency are verified with rigorous ray tracing simulations. Results of measurements with a spherically curved test mirror using the original bulk pentaprism are compared with measurements using the new mirror based pentaprism, demonstrating the improved performance.

Keywords: surface slope metrology, long trace profiler, LTP, pentaprism, alignment

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